

207c

Rubber Research Scheme

(CEYLON).

Fourth Quarterly Circular

FOR

1925.



Peradeniya, January, 1926.

GENTLEMEN,

Herewith the Fourth Quarterly Circular for 1925 dealing with the following subjects :—

“ Blanket Crepe and Thin Crepe.”

By T. E. H. O'Brien, Chemist.

“ On the Relationship between Yield of Latex and some of the Vegetative Characters in Hevea.”

By R. A. Taylor, Physiological Botanist.

“ A Preliminary Report on a Method of Treatment for Ustilina Collar Rot.”

By R. H. Stoughton-Harris, Mycologist.

“ Artificial Ageing Tests on Plantation Rubber.”

“ The Ageing Properties of Rubber extracted with Dilute Ammonia.”

“ Wet Rubbers.”

Received from the London Advisory Committee.

Reports received.

Notice reference Spraying of Rubber.

J. MITCHELL,

Organising Secretary.

RUBBER RESEARCH SCHEME (CEYLON),

Peradeniya, 16th January, 1926.

BLANKET CREPE AND THIN CREPE.

In the First Quarterly Circular for 1925 (pp. 3 and 4) some figures were given with regard to the manufacture of blanket crepe in Ceylon and thin crepe in Java, and the general conclusion was reached that blanket crepe can be produced more cheaply, as it requires less rolling than thin crepe.

Since publication of the article, information has been received that on two Ceylon estates the crop is marketed in the form of thin crepe, the total number of rollings from coagulum to finished product being 5 and 7 respectively.

Samples of thin crepe were obtained from these estates, and a sample was prepared by the writer on another estate which has rollers of a type similar to those on the 2 estates mentioned.

Details of manufacture are given in the following table:—

Estate.	Details of Rolling.		Speed Ratio of Rollers		Time of Drying.
	Grooved.	Smooth.	Grooved.	Smooth.	
A.	5 times	2 times	18:21	17:32	8 days (prepared by the writer)
B.	6 „	1 „	18:21	18:36	7 „ (Normal estate product)
C.	4 „	1 „	?	17:32	8 to 11 „ (do)

It will be noted that in each case there is a big difference in the roller speed ratio of the smooth roller, *i.e.*, one roll is revolving approximately twice as fast as the other, thus having a shearing action on the rubber. A machine of this type produces a smooth even crepe, free from large holes. Apart from appearance, this tends to promote rapid and even drying. On the majority of estates the two rolls run at approximately even speed or have a small speed difference such as 18:21.

The samples of crepe were forwarded to Dr. De Vries, Director of the Central Rubber Station, Java, who was asked to give an opinion whether the samples were up to the Java standard for thin crepe. Dr. De Vries replied that the

samples are up to Java standard. "They are thin, pale, and of even texture and would pass the Batavia Committee as 'very good.' The width however is not up to Java standard."

It appears therefore that under certain conditions thin crepe of good quality can be manufactured with less rolling than is required for blanket crepe. One of the essentials is that the smooth roller should be geared to give a large difference in the speed of the 2 rollers. On most existing machines it is not practicable to make the change from 18:21 gearing to 17:32 without installing new rolls. As far as is known to the writer it can only be done on "Robinson" machines.

It is also essential that the machines should be kept in thoroughly good order, and this would probably entail having cast iron rollers re-ground annually. New machines are now fitted with chilled steel rollers which require less frequent attention in this respect, and could be expected to run for 2 years without re-grinding. These rollers usually have a very smooth surface which does not grip the crepe properly, and it will be found that the output of the machine is disappointing unless the rollers are roughened in some way. This can be effected by sandblasting or by having small grooves cut in the rollers. A case is known in which the output of a new smooth roller increased from 45 lbs. per hour to 100 lbs. per hour, after having fine grooves cut in the rollers. This point of course is of equal importance whether the product is to be marketed in the form of thin crepe or subsequently converted to blanket.

In general it is concluded that on most Ceylon estates alteration or replacement of machinery would be required before changing over to manufacture of thin crepe, and careful attention to machinery would subsequently be required, otherwise the quality of the product would deteriorate, and a greater number of rollings would be required.

T. E. H. O'BRIEN,

Chemist, Rubber Research Scheme.

RESEARCH SCHEME LABORATORIES,

CULLODEN,

Neboba, 9th January, 1926.

NOTES ON THE RELATIONSHIPS BETWEEN YIELD AND SOME OF THE VEGETATIVE CHARACTERS IN HEVEA.

It is sometimes necessary on estates to know which are the good and which are the poor yielders, probably for thinning-out or for some other purpose, and at various times different methods of so grading the trees have been suggested. The counting of the number of latex-vessel rows in the "bark" has been put forward as a suitable method and it has also been suggested that yield from one tapping might be measured for each tree in terms of volume of latex produced. Both methods have points in favour and points against.

The following is a summary of results obtained in an experiment on the Experiment Station, Peradeniya, in which the individual Yields of 161 trees have been compared with Girth, Number of Latex Rows, and "Bark" thickness over a period of four years of tapping. The trees used for this purpose consist of seedlings grown from seeds produced by one known tree. That is, the parentage of the trees is known on the female side, but as no precautions were taken to prevent cross-pollination with the surrounding trees, nothing is known of the origin of the pollen or male gamete. The trees are now about 14 years old, and are growing on good soil and, as far as is possible in such an experiment, have had equal facilities for development.

The plot has been tapped on a half circumference without annual change-over and without rest period. Yield has been measured as weight of dry rubber produced, scrap included. Girth was measured at 3 feet and the samples of "bark" taken at 2 feet above ground level.

The results obtained are tabulated below. The Coefficient of Correlation is a figure giving a measure of the proportional

change in magnitude of one character when the other alters in either direction. The figure $+1$ would mean that if one of the characters altered in one direction the other would alter in direct proportion. -1 would mean that the alteration had taken place in inverse proportion. All figures obtained will lie between these two limits. A coefficient of $+ .5$ or over indicates what is called a marked positive Correlation between the two characters, $- .5$ is a marked negative Correlation. $- .3$ shows correlation but not marked correlation, etc.

The Probable Errors given after each coefficient are a measure of the reliability that can be placed on these; no coefficient is taken as significant unless it exceeds three times the probable error.

TABLE 1.

CHARACTERS CORRELATED.	COEFFICIENTS OF CORRELATION.		
	1921	1923	1925
Yield with Girth	... +.582 ± .035	+ .56 ± .037	+ .408 ± .045
Yield with Number of Latex-vessel Rows	... +.459 ± .04	+ .38 ± .046	+ .574 ± .037
Yield with Thickness of Untapped Cortex	... +.416 ± .044	+ .36 ± .047	+ .483 ± .041
Girth with Number of Latex-vessel Rows	... +.40 ± .046	+ .11 ± .054	+ .138 ± .053
Girth with Thickness of Untapped Cortex	... +.63 ± .032	+ .56 ± .037	+ .54 ± .037
Number of Latex Rows with Cortex Thickness	... +.34 ± .047	+ .14 ± .053	+ .23 ± .05

The figures for 1921 and 1923 are reproduced for comparison with Bulletins Nos. 55 and 68 of the Department of Agriculture, published by Messrs. Bryce and Gadd on the same subject.

It will be seen that there is a close relationship between certain of the characters. During the earlier years girth showed the most marked relationship to yield, but later the number of latex vessels in the "bark" took first place, and the figure now stands at $+ .574 + .037$ showing a marked correlation. This figure agrees with those previously published in Java.

Thickness of "bark" is also related to Yield. While the relationship between Girth and Thickness of "bark" has been maintained all through, that between Girth and Number of Latex rows has fallen away from the original high figure, and there is no very great relationship between Thickness of "bark" and Number of Latex rows.

From these results it is evident that the most efficient substitute for the prolonged measurement of Yield is, at least in the case of older trees, a cortex examination, and it has been found that thinning out 5% of the trees on a latex-vessel row basis gives little difference in yield from thinning out on an exact yield basis. This only holds of course when fairly large areas are being dealt with. The trees with the largest number of latex rows in the "bark" will very often be found to be inferior in yielding capacity to others with fewer rows, although it happens that in the present plot the highest yielder for 1924—25 has also the largest number of rows.

It is interesting to note from correlations between percentage increase in yield and percentage increase in the other factors, that yield does not increase in proportion to any of these, but is independent.

The correlation of percentage increase in Yield with percentage increase in Girth, and with percentage increase in Cortex thickness, gives a low coefficient which is not significant statistically. The conclusion is that Yield is an inherent character of the tree and does not depend for increase on the same factors as does the ordinary growth as shown by increases in Girth, etc.

It may be stated, however, that a tree which shows a high figure for any of the characters, Girth, Number of Latex rows, or Cortex thickness will usually give a yield above the average, provided the tree is healthy.

From the following table it will be seen that the highest figures recorded for these three characters are exhibited by the three trees which during the four years under review have competed for first place as yielders.

TABLE 2.

No. of tree.	Number of Latex-vessel Rows.		Girth.	Cortex Thickness.		
	Untapped "Bark."	Renewing "Bark."		Untapped.	Renewing.	
5	37	31	151 cm.	8.5 mm.	7.5	mm.
41	56	43	92.5 "	10 "	7.75	"
67	30	32	131 "	12 "	7.75	"
Highest Recorded	56	43	151 "	12 "	8.25	"

Summary.

- Yield is an inherent quality of the tree as shown by :—
 - The fact that increases in magnitude of any of the characters examined are not accompanied by proportional increases in Yield.
 - The fact that the Coefficient of Variation of Yield for the plot is very much lower than that for plots of trees of mixed parentage.
- The high Coefficient of Correlation between Yield and Girth previously given has not been maintained.
- A Latex-vessel Row count is of more value, in connection with thinning-out operations, with older trees than with very young trees.
- Girth and Thickness of Cortex are intimately related.

R. A. TAYLOR,
Physiological Botanist.

A PRELIMINARY REPORT ON A METHOD OF TREATMENT FOR USTULINA COLLAR-ROT.

It is probable that the fungus known as *Ustulina zonata*, Lev. (*U. maxima*) is responsible for the loss of more rubber trees than any other disease, particularly on older estates, where the old practice of thinning-out and leaving the logs and stumps to rot where they fell was responsible for extensive infection. The disease is very slow and insidious in its attack, and in some cases it may be ten years or even longer after the original infection before the tree is killed. It is not intended here to enter into the typical symptoms of the disease, as these are well-known, but only to describe a method of treatment that has been worked out and which seems to promise some measure of success.

By far the commonest manifestation of the disease is as a 'Collar-Rot,' the attack starting either on a main trunk-root or else on the stem at ground-level. From there it spreads upwards and inwards, but usually not to any great extent downwards along the tap-root. In this preliminary report it is proposed to deal only with the treatment of these collar-rot cases, leaving the other types to be dealt with in a later report.

On many estates the practice has been to attempt to save affected trees, provided the disease has not gone too far, by excising all the diseased tissue, tarring the exposed wood, and then either filling the cavity with some mixture or else leaving it open. The percentage of successes obtained showed that the method might repay a closer study, and some considerable time has been spent on it during the year in an attempt to improve on the present methods.

An examination of a large number of treated trees indicated that the following were the most frequent causes of failure:—

(1) Incomplete removal of all the diseased tissue. If the smallest patch of diseased wood is left it is more than probable that the disease will spread in the tree from this source.

(2) Badly-shaped cavities, giving no purchase to the filling.

(3) Too much filling used, and the filling wrongly finished off. This is perhaps the commonest error. If the

filling is brought out level with the surface of the bark and shaped to the original contour of the tree it is impossible for the callus to grow over the surface. This will be seen at once by reference to Plate I, Fig. 1, which is a diagrammatic horizontal section through a cavity. The callus, or wound-tissue, grows from the cambium at the point C, and exerts a very strong inward pressure. If the filling is brought out to the position of the dotted line it is obvious that the callus will tend to grow in behind the filling and force it out. An illustration of an actual case of this kind is given in Plate I, Fig. 2.

(4) Unsatisfactory filling-material. Many different materials have been tried from time to time, such as cement-concrete; tar, sand and cement mixtures; tar, anthill-earth and cement; asphalt with various binding materials; and so on. A filling which possesses some small degree of plasticity would appear to be the most desirable as it can be moulded to the shape of the cavity during the filling process, and the risk of cracking is diminished. Asphalt mixtures seemed the most promising, but proved too difficult to 'work.' The disadvantage of all such plastic fillings is that they must be put in while hot and soft, and it is extremely difficult to ensure that the filling, especially at the top of the cavity, will remain in place until it has cooled and set. The main drawback to cement-concrete has been its tendency to crack and the difficulty of retaining it in the cavity until the callus has grown over the surface. The method worked out seems to overcome these difficulties in a satisfactory manner, and cement-concrete or rather stone masonry with a cement mortar used as about to be described is the recommended material. Its advantages are cheapness, ease in working, and that the difficulty of repeating the exact mixture, so often experienced with plastic fillings, does not exist.

Description of Recommended Method.—The first and most important part of the work is the complete excision of *all* diseased tissue. This should be done with a chisel and mallet, and great care taken that every black line is followed up and cut away. Only clean, healthy white wood should be left. In this excavation the final shape of the cavity should be borne in mind, and care must be taken when working at the sides not to damage the healthy bark. When all diseased tissue has been cut out the cavity should be shaped. The recommended method is to "undercut" the sides all round so as to leave a ledge which will have the effect of preventing

the filling from falling out. The ideal shape to aim at is shown in diagrammatic horizontal and vertical section in Plate 2, Figs. 1 & 2. Common errors in shaping are shown in Plate 3, Figs. 1 & 2. It is very important that at the undercut edges a thickness of at least half-an-inch of (healthy) wood be left, as otherwise the bark all round the edge will dry out and die, and the cavity will probably never be callused over. This thickness of wood is seen in the diagram. An illustration of a prepared cavity is given in Plate 4, which represents the same tree as in Plate 5, re-excavated and prepared for filling.

The cavity having been shaped, all exposed wood should be very carefully tarred or treated with a strong wood-preservative, such as Brunolinum or Solignum. Care should be taken not to get this on to the cut edges of the bark itself, as otherwise burning will result and the healing process will be delayed. The cavity is then ready for filling. For this work a trained mason should preferably be employed. One mason with one cooly can fill a previously prepared cavity of a fair size in half a day, so the extra cost is not great.

Good cement and *clean* river sand only should be used. One common cause of failure is the use of dirty sand, resulting in a bad cement which soon cracks and breaks away. In filling it should be borne in mind that the cement is to be used only as a binding material or mortar for the stone and not as the principal filling-material. The whole of the inside of the cavity should be lined with a facing of a 1 : 2 cement-sand mixture as the work proceeds. The filling is built up with *clean* split stone, the larger main blocks being split to an approximately squared shape, a 1 : 3 cement-sand mixture being employed as a mortar. The ideal to aim at is that the filling should be capable of standing alone without either cement or the support from the edges of the cavity; that is to say, it should be built like a wall. The front of the filling should nowhere project beyond the plane joining the inside edges of the ledge of wood. This is shown by the dotted lines in Fig. 1, Plate 1. A half-filled cavity is illustrated in Plate 6.

When the whole cavity has been filled the surface should be faced with a 1 : 2 cement-sand mixture and finally with pure cement. The whole should present an even smooth surface, with no space between the filling and the inside edges of the ledge all round. If the work has been properly done

the filling will set to a solid mass without any cracking or shrinking away from the tree, and will be firmly held into the tree by the undercutting of the cavity. The callus is now free to grow over the surface, and by its inward pressure it will in time force the filling into even closer contact with the tree and will provide a hermetic seal round the edges. If the excision is properly carried out there is no reason why the tree should not be completely saved.

With regard to cost it is obviously difficult to give any exact figures, as this will vary for every tree according to size of cavity, position of tree, and many other factors. The average total cost per tree for a considerable number treated on Culloden Estate by this method, but using a trained cooly instead of a mason, was about Rs. 4/- per tree. Taking every care to use only clean sand and clean split stone, and with a mason to do the work of filling, the cost should not exceed Rs. 6/- per tree. The method should prove profitable, therefore, if the tree is saved for any period longer than about two years.

Naturally, discretion must be used in deciding to treat any tree by this method. If the disease has spread through more than half the diameter of the tree, or if the tree is a poor yielder, it would not be worth while to undertake the work. Only good yielding trees where the disease has not gone too far should be treated.

R. H. STOUGHTON-HARRIS,

Mycologist.

RESEARCH LABORATORIES,
CULLODEN ESTATE,
Neboda, January 8th, 1926.

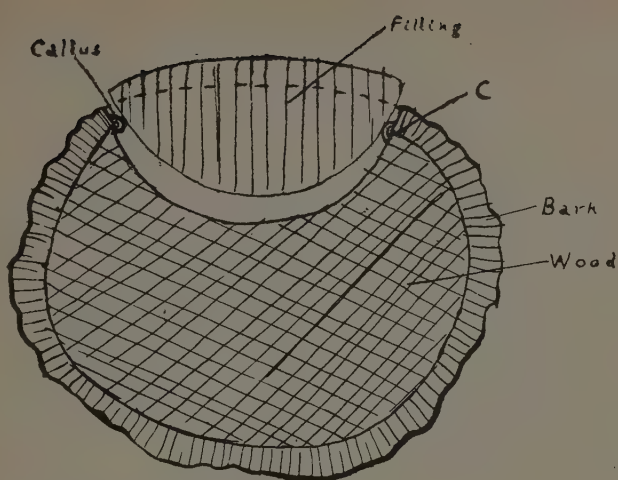


Fig. 1. Horizontal Section.

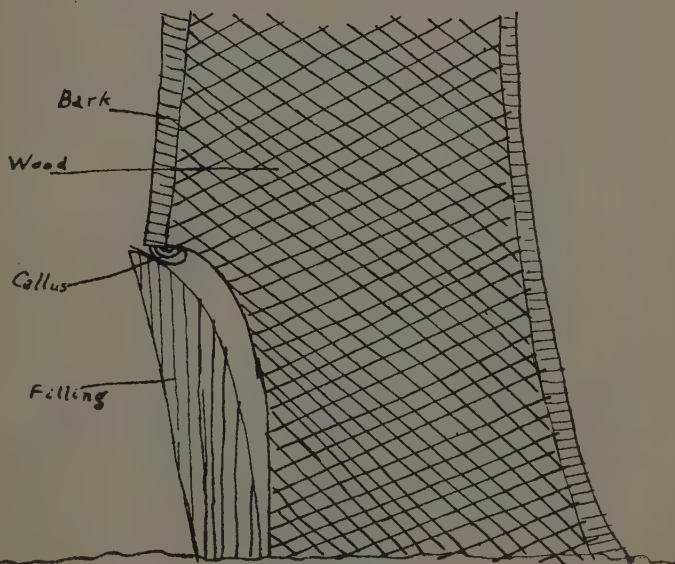


Fig. 2. Vertical Section.

LATE I. Diagram of Tree treated for Ustulina Collar-Rot, showing incorrect method.

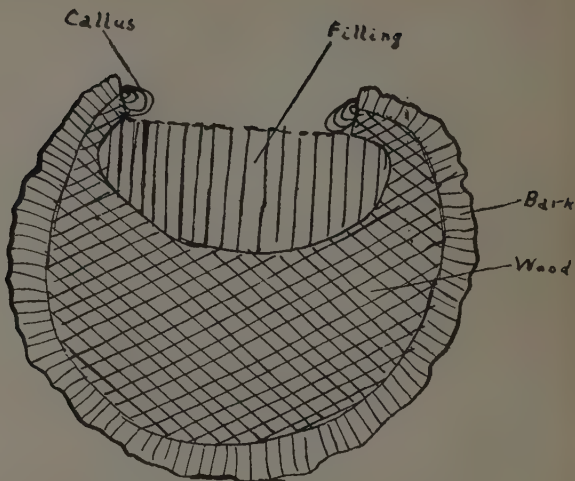


Fig. 1. Horizontal Section.

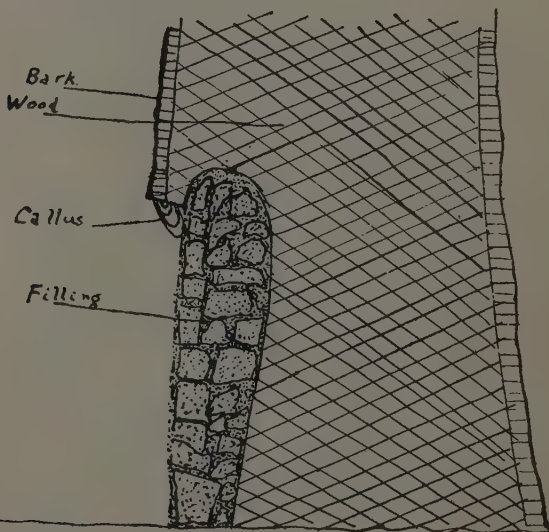


Fig. 2. Vertical Section.

PLATE 2. Diagram showing correct method of excavating and filling cavity.

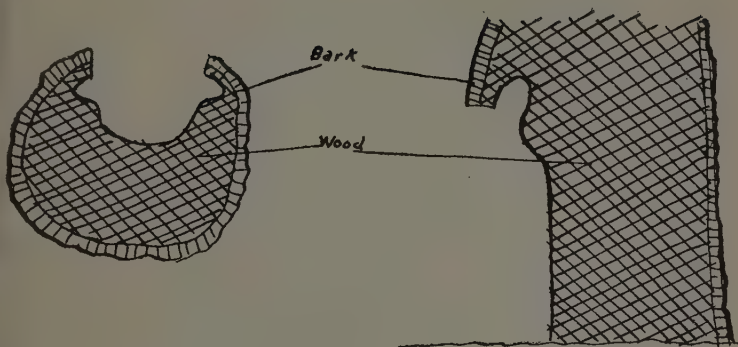


Fig. 1. Cavity out so as to leave a 'shoulder'

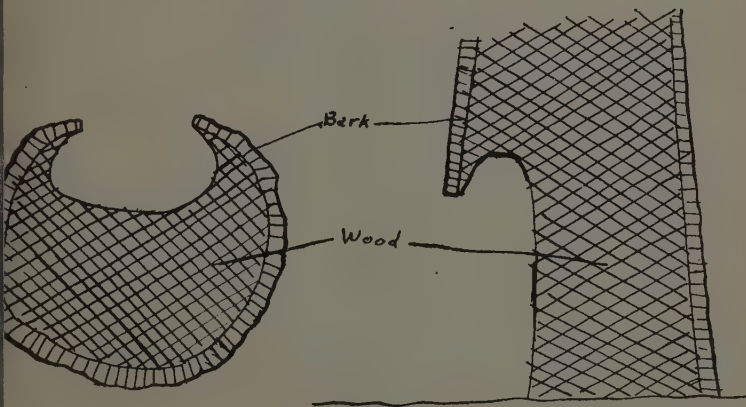


Fig. 2. Cavity undercut without leaving ledge of wood at sides.

ATE 3. Diagrams showing common errors in excavating cavities.



PLATE 4. Tree badly excavated and filled.



PLATE 5. Same tree as in Plate 4 re-excavated and prepared for filling.



PLATE 6. Tree half-filled, showing method of building.



PLATE_7. Same tree as in Plate 6 completed.

ARTIFICIAL AGEING TESTS ON PLANTATION RUBBER.

It is well known that vulcanised rubber articles eventually perish on exposure to light and air. They become very weak and usually harden, but sometimes soften and become tacky. Numerous attempts have been made, by additions to the rubber mixings, to prevent this deterioration on "ageing" and continued efforts to effect improvements in this direction are part of the routine of rubber factory practice.

It seems possible that different methods of preparing the raw rubber may have some effect on the ageing properties of the vulcanised product, but this aspect of the question has received comparatively little attention.

Having regard to the importance of the subject, a detailed investigation is being made of the behaviour on ageing of different forms of plantation rubber. It is also proposed to make a series of comparative tests with fine hard Para. This rubber is preferred to plantation rubber for the manufacture of articles (such as golf ball tape and elastic thread) where a rubber-sulphur mixing is employed, and it has been suggested that this preference is connected with differences between the ageing properties of the rubbers in this mixing.

The first set of experiments has been carried out on a series of samples (Series II) which were being submitted to vulcanisation and mechanical tests. These samples consisted of duplicate sets prepared from bulked latex on four estates in different parts of Ceylon, each set consisting of crepe, crepe blocked after varying periods of drying, unsmoked sheet and unsmoked sheet rolled up after varying periods of drying. It was considered that the wet samples might be of special interest for comparison with fine hard Para, which contains appreciable amounts of moisture on arrival in the United Kingdom.

In consequence of the time involved in carrying out natural ageing tests and the difficulty of maintaining uniform conditions, the ageing properties of the samples were determined in accordance with the usual practice by exposing suitable specimens to a temperature of 70°C in a slow current of air. Exposure for 24 hours under these conditions is generally regarded as equivalent to that of storage in the dark for six months.

Full particulars of these investigations and of the results obtained will be given in Bulletin 41.

The control samples of unsmoked sheet were a little stronger on vulcanisation than the corresponding crepes from the same estate. On ageing for 48 hours the tensile strengths of the sheets showed a marked increase, but those of the crepes only increased slightly. There were considerable differences in the tensile strengths developed on ageing by the sheets from the different estates but the crepes were more uniform.

The sheets did not commence to weaken rapidly until aged for 144 hours, but the crepes rapidly weakened after ageing for 96 hours.

Blocking the crepe and rolling up the sheets had no effect on the ageing properties, nor had variations in the amount of moisture present.

As the ageing properties of rubbers are greatly effected by the degree of vulcanisation, a series of tests were made at several vulcanisation coefficients on single samples of rolled sheet and blocked crepe and it was found that the rolled sheet not only deteriorated more slowly than the blocked crepe when vulcanised to the same coefficient but also when vulcanised to a distinctly higher coefficient.

Conclusions.

The results of the investigation indicate that unsmoked sheet has the following advantages over crepe when vulcanised in a rubber-sulphur mixing:—(1) Better tensile strength, (2) Retention of tensile strength for a much longer period after vulcanisation, and (3) a greater latitude of cure.

On the other hand it has been shown previously that unsmoked sheet is less plastic than crepe and more variable in time of vulcanisation (*see* 3rd Quarterly Circular, 1925.)

Comparative ageing tests are now in progress with smoked sheet and fine hard Para.

31st December, 1925.

THE AGEING PROPERTIES OF RUBBER EXTRACTED WITH DILUTE AMMONIA.

It has previously been shown that crepe rubber prepared by coagulating ammonia-preserved latex with acetic acid possesses inferior ageing properties (First Quarterly Circular, 1925, p. 12). In order to investigate further the effect of ammonia on the ageing properties of rubber, one half of a sample of unsmoked sheet was extracted with several changes of dilute ammonia solution for a period of several weeks, and the other half with water. Marked putrefaction occurred in the case of the water extracted, but not in the case of the ammonia extracted portion. About 2 per cent. of organic matter, which yielded 9.6 per cent. of ash, was extracted by the ammonia solution, but very little was removed by the water.

Vulcanisation and ageing tests in a rubber-sulphur mixing were carried out with both portions of the sheet after the above treatment, and the results are as follows:—

	Time of Vulcanis- ation. (mins.)	Ageing Period at 70°C. (hrs.)	Tensile Strength. (lbs./sq. in.)	Elongation at load of 1.04 kgs./sq. mm. (per cent.)
Rubber extracted with ammonia ...	61	nil	1,680	878
		96	230	—
Rubber extracted with water ...	54	nil	2,160	880
		96	1,870	697
		144	300	—

The water extracted sample vulcanised quickly, no doubt due to the putrefactive changes which occurred. Its tensile strength before ageing was satisfactory, but on ageing it deteriorated rather more quickly than ordinary unsmoked sheet. The ammonia extracted sample was inclined to be weak before ageing and deteriorated very rapidly; it was very much inferior to the water extracted sample.

The rubber extracted with ammonia solution showed distinct signs of tackiness after two months whilst the rubber extracted with water was still in good condition.

The accessory substances in rubber include a number of compounds which may be expected to react with ammonia. It is possible that in the experiment described above the ammonia extracted from the rubber some substance which has a beneficial effect on the ageing properties.

An examination of the ammonia extract is being made with a view to determining its nature and its effect on the ageing properties of rubber.

December, 1925.

WET RUBBERS.

Experiments made in connection with the Ceylon Rubber Research Scheme on a small scale some time ago indicated that crepe blocked wet and unsmoked sheet rolled up wet gave very satisfactory results on vulcanisation in a Rubber-sulphur mixing. The number of samples examined was not sufficient to enable definite conclusions to be drawn, and it was accordingly decided in connection with the revised scheme to make a detailed comparison of wet and dry rubbers prepared in different parts of the Island and during different seasons of the year.

These investigations, which have recently been completed, comprise (1) vulcanisation and mechanical tests in a rubber-sulphur mixing and in accelerator-zinc oxide mixings, which are largely employed in industry; (2) tests of the physical properties of the raw rubber; and (3) ageing tests on the vulcanised product.

Full particulars of these investigations are given in R. S. Bulletin No. 39.

The results indicate that crepe blocked wet and unsmoked sheet rolled up wet possess no important advantages over dry crepe and sheet, either as regards tensile strength or uniformity in time of vulcanisation. Further it has been found that the wet and dry forms do not differ markedly either in plasticity (*see* 3rd Quarterly Circular, 1925) or in ageing properties (*see* 1st Quarterly Circular, 1925).

REPORTS RECEIVED.

Report on "Rubber prepared from Latex obtained from Trees sprayed with Bordeaux Mixture."

Report on "The Vulcanising and Mechanical Properties of Wet Blocked Crepe and Wet Rolled Sheet" (to be issued as Research Scheme Bulletin No. 40).

Report on "The Ageing Properties of Rubber extracted with Dilute Ammonia" (included in present Circular).

Report on "Artificial Ageing Tests on Plantation Rubber" (Extract included in present Circular).

NOTICE.

SPRAYING OF RUBBER.

With a view to controlling secondary leaf-fall on Ceylon Rubber Estates considerable attention is to be directed during 1926 to the possibilities of spraying as a preventive. The Executive Committee of the Research Scheme has made arrangements for the Mycologist of the Scheme to visit South India during the spraying season there in order to enquire into all questions in connection therewith prior to carrying out experiments in Ceylon. In addition, many estates propose to carry out experiments on their own account. It is notified to all Members that should estates experience difficulties in connection with these spraying experiments the Research Scheme Officers will be pleased to give every possible assistance. Communications should be addressed to the Organizing Secretary, Rubber Research Scheme, Peradeniya.

MILLER & Co.



Printers

Stationery

KANDY.